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January 19, 2004

Gary Wm. Baun
O'Bryan Law Center, P.C.
401 S. Old Woodward, Suite 320
Birmingham, MI 48009

REF: Terry Nichols vs. Indiana Michigan Power Co., et.al.

Dear Mr. Baun,

This letter is in response to your request for an ergonomic analysis of the task performed by Mr. Terry Nichols on August 27, 2001 while working as a deck hand at the Philip Sporn Power Plant Coal Barge Loading Operation of Indiana Michigan Power Co...

I have had the opportunity to review the following materials that you provided:

1. Plaintiff's Depositions (7/10/2002 and February 12, 2003)
2. Deposition of Mark A. Clay (July 30, 2002)
3. Deposition of Timmothy Ramey (July 10, 2002)
4. Deposition of Steven Edens (November 26, 2002)
5. Deposition of Jeff Darst (February 12, 2003)
6. Deposition of Michael A. Weisend (July 30, 2002)
7. Deposition of Mark Clay (February 12, 2003)
8. Deposition of Charles Johnson (February 12, 2003)
9. Plaintiff's Mediation Facilitation Summary w/ Exhibits A-O (June 11, 2003)
10. Commercial Wire Rope & Supply CO. brochure
11. 37 color photographs taken during site inspection

I also had the opportunity to conduct a site inspection of the Sporn Plant barge loading operations on September 25, 2003.

A review of the plaintiff's medical history reveals that Dr. McCleary diagnosed and treated Mr. Nichols for the following injuries (1) a torn rotator cuff injury to right shoulder, (2) superior labral tear of right shoulder, and (3) herniation of the cervical discs at C5-6 and C6-7. Mr. Nichol's herniated cervical discs were subsequently operated on by Dr. Todd. Both physicians believe the injuries sustained were caused by and permanently disabling from deckhand tasks.

Based on the pre-employment physical exam of plaintiff, it is noteworthy that Mr. Nichols is 5'7" tall and weighs approximately 151#. I have tailored my analysis to a person of Mr. Nichol's anthropometry, however since he is anatomically so close to the average male (5'9",170#) all interpretations would apply to the typical deckhand.

My conclusions are based upon a biomechanical analysis of the external and internal stresses imposed on the shoulder and spine while handling pull cables during coal barge loading operations. This is accomplished using The University of Michigan's 3DSSP Model. This model provides a 3 dimensional biomechanical analysis of the stresses on each joint in the body, and the shoulders and spine in particular. The model has been widely adopted by many companies and government agencies as the most authoritative model currently available to occupational health and safety professionals. This model has been available for approximately 30 years; the current version is 4.3.

Based upon the biomechanical analysis (see attachment) it is apparent that transferring of cables between barges can be a highly stressful task to the shoulders and spine. The primary contributors to these stresses are the extremely high forces measured (178# pull force) and the awkward postures (transferring of lines from upper barge cables to the lower barge by extending hands overhead). Since these forces exceed the average person's body weight, it would be expected that a deckhand would routinely lose balance, drop cables, or slip and fall between the barges (required coefficient of friction 1.18).

Three separate analyses were conducted. The first depicts the required posture at the moment of handoff between deck hands on adjacent barges. The second depicts an "ideal posture" for the pulling task. The third depicts the posture required to connect the cable to the barge. Only in the second posture is the risk of slipping and falling within acceptable limits. In all 3 postures the forces required exceed safe limits.

It is estimated that 1137 in-lbs of abduction torque is applied to the right shoulder during the handoff operation (another 1061 in-lbs force on the left shoulder). Comparing these to average male capabilities 661 in-lbs. in this posture (623 in-lbs capability of left shoulder), it is estimated that no one would have the necessary muscle strength to accomplish this task safely. Since the forces are 1.7 times the maximum static strength capability of the shoulder joint it is expected that injury to the connective tissues of the shoulder would occur (e.g. rotator cuff tear, muscle strain, etc.).

The compressive loadings on the spine also exceed safe limits. While an exact estimate of the compressive load on the C5-6 and C6-7 discs, in particular, is unavailable, it is clear that that the compressive loading on the spine would exceed compression loading guidelines of 770 lbs throughout the spine. For example, the estimated loading on the lower lumbar spine (L5-S1) are estimated at 1740 lbs or 2.25 times acceptable isometric limits (770#).

This task, as demonstrated and measured, significantly violates the National Institute for Occupational Safety and Health (NIOSH) criteria for safe manual materials handling based on both spinal disc compression and muscle strength required in the upper extremities. NIOSH requires that all tasks be designed within the capability of 75% of the population. Clearly, this task fails for industrial male populations in particular and multi-gender populations as well. Further the spinal compression values exceed 770# which has been shown in numerous studies to create compression failures and herniations of spinal discs.

The risks of overexertion injury to Mr. Nichols are clearly foreseeable and avoidable. Ordinarily such tasks would only be performed with slack lines so the deckhand is not required to maneuver heavy steel cables but only rope ties.

In summary, the act of transferring cables between barges as demonstrated in this case creates significant mechanical trauma and stress to the shoulders, neck, and back. It is expected that such tasks will create sufficient trauma to result in either or both shoulder strain injury or spinal disc herniation as sustained by Mr. Nichols. The stresses exceed all recommended guidelines and could be corrected with appropriate engineering or administrative controls (e.g. training and enforcement of safety rules).

I trust these analyses are useful. If I may be of further assistance please advise.

Sincerely,

Gary D. Herrin, Ph.D.
Asst. Dean and Professor